Precision Abrasive Machinery, Inc.

14200 W. COMMERCE RD. * P.O. BOX 43 * DALEVILLE, INDIANA 47334
(765) 378-3315 * FAX (765) 378-3316

11-04-97

AUTOMATIC CARBIDE ROD CUT OFF SAW

1.0 FUNCTION KEYS

1.1 **F1** CYCLE START - This Key is only active while in automatic mode. It is used to start the automatic cycle and resume cycle while in single cut mode or after using **F12** STOP AFTER CUT.

1.2 **F2** MODE SELECT AUTO/MANUAL - After clearing any fault conditions machine will be in MANUAL MODE. In this mode each axis may be jogged and all machine functions may be performed. Pressing **F2** will switch the machine to AUTOMATIC MODE. In this mode, data entries may be made and Auto Cycle may be started. Pressing **F2** again will change the machine back to Manual Mode.

1.3 **F3** WHEEL MOTOR START/STOP - This Key is only active while in Manual Mode and is used to Start and Stop the Wheel Motor. (1st press = ON, 2nd press = OFF).

1.4 **F4** COOLANT OFF/ON - This Key is only active while in Manual Mode and is used to toggle the Coolant Valve "ON" and "OFF". (1st press = ON, 2nd press = OFF).

1.5 **F5** LOADER EXTEND/RETRACT - Air Cylinder Equipped Models Only. This Key is only active in Manual Mode and is used to Extend and Retract the Loader Rod Cylinder.(1st press = ON, 2nd press = OFF).

1.6 **F6** CLAMP OFF/ON - This Key is only active while in Manual Mode and is used top Open and Close the Clamp. (1st press = OPEN, 2nd press = CLOSE).

1.7 **F7** AXIS SELECT TOOL BED / WHEEL HEAD / PUSHER - This Key is active while in Manual Mode and is used to select the desired Axis to be jogged. Upon entering the Manual Mode, after Homing the machine or after clearing a fault condition, the Tool Bed Axis is the default selection. Each press of the **F7** Key toggles the Axis Selection from TOOL BED -> WHEEL HEAD -> PUSHER -> TOOL BED.

1.8 **F8** JOG SPEED FAST/SLOW - This Key is active while in Manual Mode and is used to select the desired jog speed. Upon entering the Manual Mode, after Homing the machine or after clearing a fault condition, Jog Slow is the default selection. Each Press of **F8** toggles the jog speed between Slow and Fast. The current jog speed selection is shown at the lower left of the O.I.U. Display screen.

1.9 **F9** SEND PUSHER & WHEEL HEAD HOME - This Key is only active while in Manual Mode and is used to return the Pusher and Wheel Head Axis to their Home Positions.

1.9a TO HOME The TOOL BED AXIS - After each machine Power Up, the O.I.U. will display a screen to "Home Axis" by pressing **CLEAR** or **F9**. After the Homing function, the Tool Bed Axis will need to set to Home and Zero.
The Tool Bed Axis is set to "Home and Zero" by manually jogging the Tool Bed Axis to a proper distance back to fill the Tool Bed with carbide rods. After this has been established, the Tool Bed Axis will 'auto' return to its Home position after the Tool Bed has reached its End Limit Switch.

1.10 **F10** SPARE FUNCTION KEY

1.11 **F11** STOP BEFORE NEW ROD - This Key is only active during an Automatic Cycle. Pressing **F11** during an automatic cycle will cause the machine to Cycle Stop before loading a new rod, Shut Down Auto Cycle and STOP the Wheel Head and Coolant motor. Press F1 to start a new cycle.

1.12 **F12** STOP AFTER CUT - This Key is only active during an Automatic Cycle. Pressing **F12** during an automatic cycle will cause the machine to pause upon completion of the current cut. Press **F1** to resume normal operation.

2.0 OTHER OPERATOR CONTROLS.

2.1 **EMERGENCY STOP** - When this button is pressed in, all machine functions are stopped (the clamp will lock close) and "E-STOP FAULT" will be shown on the O.I.U. display.

2.2 **JOG FORWARD** - This Pushbutton is only active in Manual Mode and is used to jog the currently selected axis, displayed by the O.I.U. , in the direction *opposite* of its Home Position. If the Pusher Axis is selected, the Clamp must be in the open position before this Pushbutton will be active. If the Wheel Head Axis is selected, the Clamp must be in the closed position before this Pushbutton will be active.

2.3 **JOG REVERSE** - This Pushbutton is only active in Manual Mode and is used to jog the currently selected axis, displayed by the O.I.U. , in the direction of its Home Position. Jog Reverse is not active beyond the Home Position Limit.

2.4 **IN CYCLE** - This Pilot Light is only active in Automatic Mode and will be illuminated during and automatic cycle. If Single Cut Mode is selected or F12 STOP AFTER CUT was pressed, this Light will go off upon completion of the current cut.

2.5 **CYCLE DONE / FAULT FLASHING** - This Pilot Light flashes during a Fault condition or illuminates upon completion of the current cut, if Single Cut Mode is selected, or F12 STOP AFTER CUT was press.

3.0 INITIAL MACHINE POWERUP

3.1 Pulled out the Emergency Stop and connect and turn on the Air Supply. Next, turn on the Disconnect Switch. Then the following O.I.U. message will be displayed.

3.2 POWER-UP FAULT
CLEAR=RESET

3.3 Press the **CLEAR** Key on the O.I.U. to clear this fault and the following message will be displayed on the O.I.U.

3.4 HOME REQ'D
PRESS CLEAR

3.5 This message is to alert the operator that the Pusher and Wheel Head Axis must be sent to their Home positions. While this message is displayed, pressing the **CLEAR** or **F9** Key on the O.I.U. will send the **Pusher** and **Wheel Head** Axis to their ***Home*** positions.
If this screen changes and appears again, then the Tool Bed Axis may need to be set to Home and Zero. See Section 1.9A on page 2.

3.6 After Homing the Pusher and Wheel Head Axis, the following message will be displayed on the O.I.U.

3.7 MANUAL TOOL BED
SLOW 0.0000

3.8 This message should be considered as four separate sections. "MANUAL" at the upper left of the display is to alert the operator that the machine is in the MANUAL MODE. **TOOL BED** at the *upper right* of the display indicated that the Tool Bed is the currently selected Axis (pressing **F7** would replace **TOOL BED** with **WHEEL HEAD** and then **PUSHER**). **SLOW** at the *lower left* of the display indicated that a slow jog speed selected (pressing **F8** would replace **SLOW** with **FAST**). The **0.0000** (**X.XXXX** Resolution) at the *lower right* of the display represents the current position, relative to Home, of the selected Axis in Inches(Home = 0.0000).

4.0 ADJUSTING TOOL BED POSITION.

4.1 The TOOL BED "Home and Zero" position, for *New Rod Diameter Setup* is adjusted by Jogging the "Tool Bed Rod Pusher Plate" FORWARD or BACKWARD. Then place enough Carbide Rods on the Tool Bed so that the rods will not pyramid when being pushed forward. Check this by jogging the Tool Bed *Slow* Forward, enough distance, to observe that the rods do not pile up.

4.2 Next, for *New Rod Diameter Setup* , jog "Tool Bed Rod Pusher Plate", BACKWARD or FORWARD, to desired position to fill with carbide rods. Then, **important**, jog "Tool Bed Rod Pusher Plate" FORWARD until a rod falls into the "Pusher Vee". This will "Zero" the Tool Bed so it will increment the other rods into the Vee.
DO NOT REMOVE THIS ROD!

4.2a *Tool Bed Sequence Information*: The Tool Bed Sequence is designed NOT TO INDEX the First Rod from its "Home Zero" Position.

The TOOL BED will advance rod to rod until it reaches its End Limit and then it will return to it defined "Home Zero" Position. The machine will then attempt to push the first rod of the next batch that is not present and then the machine will time out, because of no rods, and a Fault message will appear. The "Tool Bed Rod Pusher Plate" will still be at "Home Zero" Position. A message on the O.I.U. screen will request to clear the fault message and then HOME Axis. Follow the Commands.

4.3 *Refilling the TOOL BED (same diameter from setup)*: After the machine has run out of rods, the TOOL BED is at prior "Home Zero", and Homing is done, refill the TOOL BED with carbide rods and then simply place a rod in the "Pusher Vee". Then press **F1** to start a new run.

4.4 Refilling the TOOL BED with a *new rod diameter*. See 4.1

5.0 ADJUSTING PUSHER HOME POSITION.

5.1 After adjusting the TOOL BED for the *New Rod Diameter Setup*, the PUSHER Home Switch Target (split donut or torus shape)must be adjusted for carbide rod length.

5.2 The PUSHER Home Switch Target is located on the front side, left end of the Pusher Table on an adjustment slide rod. As viewed from the operator position.

5.3 Select Manual Mode (**F2**) if needed, Select PUSHER (**F7** three times)to the PUSHER screen.

5.4 For Shorter Rod Lengths, *that being a farther distance from the existing Split Donut target*, first Jog PUSHER Forward from the Split Donut Target to a place that leaves a extra 1 Inch clear distance between the PUSHER END PIECE and the end of the rod. Then loosen the Socket Head Set Screw on the Donut shaped target and slide the Target up to the Left Hand Proximity Switch close enough to make the Prox. Sw. signal. Then tighten the Socket Head Set Screw on the Donut shaped target. Then press **F9** to Home axis. Check for 1 Inch (+/-1/4") Clearance distance.

5.5 For Longer Rod Lengths, *that being a lesser distance from the existing Split Donut target*, first move the Split Donut Target, home ward, to a place that leaves [1 Inch clear distance + the difference between the PUSHER END PIECE and the end of the rod]. Then tighten the Socket Head Set Screw on the Donut shaped target. Then press **F9** to Home axis. Check for 1 Inch (+/-1/4") Clearance distance.

6.0 AUTO SETUP

6.1 After adjusting TOOL BED(Home Zero) and PUSHER(Home) and Homing Axis(**F9**), several Data Entries must be reviewed before attempting an Automatic Cycle.

6.2 Press **F2** to enter the Automatic Mode and the following message will be displayed on the O.I.U.

6.3 SINGLE CUT F5
FULL AUTO F6 FA

6.4 While this message is displayed, Single Cut Mode(**F5**) or Full Automatic Mode(**F6**) may be selected. In Single Cut Mode, the machine will pause after each cut until **F1** is pressed to resume operation. In Full Automatic Mode, the machine will cycle continually until the TOOL BED is empty. See Section 4.3-4.4 *Refilling the TOOL BED.*
The **FA** at the lower right of the display indicates that **Full Auto** Mode is selected. If *Single Cut* Mode is desired press **F5** and then **FA** will be replaced by **SC** on the display to indicate that **Single Cut** Mode is selected. When changing from *Single Cut* Mode to *Full Auto* Mode, while machine is paused after cut, the machine will immediately resume operation when **F6** is pressed. When a selection of Single Cut or Full Auto has been made, press the "UP" Arrow Key on the O.I.U. and the following message will be displayed on the O.I.U. screen.

6.5 FRONT NIP NO
YES=F5 NO=F6

6.6 While this message is displayed, the operator may choose whether or not to make a trim cut on the front of each Rod(FRONT NIP). If Front Nip is desired, press **F5** and **NO** at the upper right of the display will be replaced by **YES** to indicate the Front Nip is selected. Press **F6** if NO Front Nip is desired. When this selection has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.7 NIP AMOUNT
0.062 IN.

6.8 While this message is displayed, the length of the Front Nip may be entered. The bottom line of this message indicates the current Front Nip length in Inches. To change this amount, enter the desired amount using the *Numeric keys* on the O.I.U. keypad. When changing data entries, the value displayed on the O.I.U. will flash. If a mistake is made during number entry, just press the **CLEAR** Key and the previous value will be displayed, then reenter the desired value. When the desired value is flashing, press the **ENTER** Key. The displayed value will stop flashing and will show the new entry. When making entries that are less than 1.000 , press **0** (Zero), then a **.(decimal-point)**, then the ***remaining decimal number***. The minimum amount that may be entered here is 0.062 Inches. When the correct number has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

Note: If Front Nip was set to NO disregard this message and skip to the next Screen. Use the "UP" Arrow Key.

6.9 ENTER WHEEL
WIDTH 0.040

6.10 While this message is displayed, the Wheel Width may be entered. If a different width wheel is installed be sure to change the value. This message is also useful to adjust second and consecutive cut lengths (if second cut from rod is too short add that amount to the Wheel Width factor). When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.11 ENTER ROD DIA.

0.0630 IN.

6.12 While this message is displayed, the Rod Diameter may be entered. The bottom line of this message indicates the current Rod Diameter setting in Inches. Measure the Rod Diameter and enter the amount here. The minimum amount that may be entered here is 0.0630 In and the maximum is 1.0625 In. When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.13 PRIMARY CUT

LENGTH 2.500 IN

6.14 While this message is displayed, the Primary Cut Length may be entered. This machine is capable of cutting two different cut lengths from each rod. It first makes the Primary Length Cuts until the amount set at section 6.15 is satisfied, then it makes the Secondary Cut Lengths from the Remainder of the rod until the Pusher Done Proximity Limit Switch is energized. This Limit Switch is located on the front side, right end of the PUSHER Table. ***The Pusher Done Limit Donut Target has been factory set and should not be moved.*** After energizing the Pusher Done Limit, the PUSHER returns Home to receive the next rod. At this time the Primary Length Accumulated Count is reset and this cycle may be repeated. If only one cut length dimension per rod is desired the number of Primary Cuts set at section 6.15 may be set to a number greater than possibly obtainable from the Rod Length being cut, or the Secondary Cut Length set as section 6.17 may be set the same as the Primary Cut Length section 6.13. The minimum amount that may be entered here is 0.060 Inch and the maximum value is 12.75 Inch. When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.15 NUMBER OF PRI.
CUTS 999

6.16 While this message is displayed, the desired number of Primary Cuts may be entered (see section 6.14 for explanation). When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.17 SECONDARY CUT
LENGTH 3.500 IN

6.18 While this message is displayed, the Secondary Cut Length may be entered (see section 6.14 for explanation). The minimum amount that may be entered here is 0.060 Inch and maximum is 12.75 Inch. When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.19 MAJOR CUT SPEED
2.00 I.P.M.

6.20 While this message is displayed, the WHEEL HEAD Axis major cutting speed in inches per minute may be entered. The minimum amount that may be entered here is 0.01 I.P.M. and the maximum is 4.00 I.P.M. If the Break Thru Speed is set to **NO** the entire cut will be at this speed (see section 6.21 for more detail on Break Thru Speed). When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.21 BREAK THRU SPD N

YES=F5 NO-F6

6.22 While this message is displayed, the *Optional* Break Thru cutting speed may be selected. This machine is capable of using two different WHEEL HEAD Axis feed speeds during each cut. If the Break Thru Speed Option is set to **NO**, the Major Cut Speed entered at section 6.19 will be used during the full cut. If the Break Thru Speed option is set to **YES**, the cut will start at the Major Cut Speed and then change to the Break Thru Speed (entered at section 6.25) when it reaches the percent of the rod diameter (entered at section 6.23) and finish the cut. If the Optional Break Thru Speed is desired press **F5** and the **N** shown at the upper right of the display will change to a **Y** indicating that Break Thru Speed is selected. If no Break Thru Speed is desired press **F6** and an **N** will appear at the upper right of the display indicating that no Break Thru Speed is selected. When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

6.23 START BREAK THRU

SPEED AT 75%

6.24 While this message is displayed, the percent of the rod diameter to travel before changing to the Break Thru Speed may be entered. Then minimum amount that may be entered here is 75% and the maximum is 95%. When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.

*Note: If Break Thru Speed (at section 6.21) was set to **NO** disregard this message and skip to section 6.27.*

6.25 BREAK THRU SPEED

0.01 I.P.M.

6.26 While this message is displayed, the WHEEL HEAD Axis break thru cutting speed may be entered in Inches Per Minute. The minimum amount that may be entered here is 0.01 and the maximum is 4.00 I.P.M. When the correct entry has been made, press the "UP" Arrow Key and the following message will be displayed on the O.I.U. screen.
*Note: If Break Thru Speed (at section 6.21) was set to **NO** disregard this message and skip to section 6.27.*

6.27 SENSOR TO WHEEL

+F5 -F6 1.125

6.28 While this message is displayed, the recognized distance from the Pusher "Rod Edge Proximity Sensor" to the left edge of the cutting wheel (used for internal calculations) may be adjusted. This distance will only effect the first cut from each rod. Due to various rod densities and mass (size), the location of the Proximity Sensor and its sensitivity setting, the Proximity Sensor will not activate at the same setting for all diameters. If the first cut from the rod is too short, add the difference of being short to the Wheel to Sensor value by pressing **F5** (each press of **F5** will add 0.0012 Inches). Holding **F5** will advance the value 1 increment per second for approx. 5 seconds. After holding **F5** for approx. 5 seconds, the will advance the value 10 increments per second. Then after holding **F5** for approx. 15 seconds, the will advance the value 100 increments per second. If the first cut form the rod is too long, subtract the difference of being short to the Wheel to Sensor value by pressing **F6** (each press of **F6** will add 0.0012 Inches). **F6** has the same progressive effect when held down. Press the "UP" Arrow Key and the following message will be displayed on the O.I.U screen.
Note: An Addendum will be supplied to illustrate how to calculate the ROD END PROXIMITY SENSOR with an example spread sheet chart.

6.29 WHEEL WEAR COMP
+F5 -F6 1.1250

6.30 While this message is displayed, the Wheel Wear may be compensated. The value shown at the lower right of the display represents the distance from the PUSHER VEE Center to the outside diameter of the Cutting Wheel when the WHEEL HEAD Axis is at its home position. Each press of **F5** will add 0.001 Inches to this distance and to the HEEL HEAD Axis Software Over Travel Limit. Each press for **F6** will subtract 0.001 Inches. Press the "UP" Arrow Key and the following message will be displayed on the O.I.U screen.
Note: Be sure to reset Wheel Wear Comp. when installing a new Wheel (see section 6.31).

6.31 WHEEL WEAR COMP.
RESET=F5

6.32 While this message is displayed, the Wheel Wear Compensation may be reset. Be sure to reset Wheel Wear Comp. when installing new Wheels or if the recognized distance from the Pusher VEE Center to Wheel O.D. of the WHEEL HEAD Axis (when at Home position) is altered (see section 9.0). Pressing **F5** while this message is displayed will return the recognized distance from the Pusher VEE Center to Wheel O.D. of the WHEEL HEAD Axis and the WHEEL HEAD Axis Over Travel Limit back to their Original settings. Reset may be confirmed by checking the value displayed at section 6.29. Press the "UP" Arrow Key and the following message will be displayed on the O.I.U screen.

6.33 CYCLE START=F1
CYCLE STOP=F12

6.34 This is a read only message that marks the end of the data entry messages and reminds the Operator that **F1** is Cycle Start and **F12** is Stop after each cut. Pressing the "UP" Arrow Key will return the O.I.U. display to the message shown at section 6.3.

Note: Pressing **F11** during an automatic cycle will cause the machine to Cycle Stop before loading a new rod, Shut Down Auto Cycle and STOP the Wheel Head and Coolant motor. See section 1.11.

6.35 Notes to Auto Setup

6.35a The Machine will be in Automatic Mode when any of the messages at section 6.3 to 6.33 are displayed on the O.I.U. screen. **F1** (Cycle Start) may be initiated while any of these massages are displayed.

6.35b Changes made to data entries during an Automatic Cycle will not take effect until the next use of that entry.

6.35c Using the "DOWN" Arrow Key will scroll thru the O.I.U. messages in reverse order.

7.0 AUTOMATIC CYCLE SEQUENCE

7.1 After adjusting the Pusher Home Limit Donut Target and reviewing all data entries, an Automatic Cycle may be executed. The Following sequence takes place.

7.2 The Machine must be in Automatic Mode. While in Automatic Mode, the Operator will have control of the O.I.U. displays using the "UP" or "DOWN" Arrow Keys.

7.3 After the first Bed of rods is cut or the first bed of rods is interrupted, the Operator must place the a rod of the next batch onto the Pusher VEE before Cycle Start.

7.4 The Operator presses **F1** cycle start.

7.5 The Cycle On light Illuminates and the Wheel and Coolant Motor starts.

7.6 The Clamps Open.

7.7 After first rod is cut the TOOL BED then Indexes the next rod onto the PUSHER VEE.

7.8 The PUSHER advances slowly until the Rod End Prox. Sensor detects the end of the rod. If the sensor noes not detect a rod within 7 seconds, the machine shuts down and the NO ROD FOUND fault screen is displayed.

7.9 If Front Nip was selected, the PUSHER moves the rod the distance of the "Sensor to Wheel" + "Wheel Width" + "Nip Amount".

7.10 If Front Nip was NOT selected, the PUSHER moves the rod the distance of the "Sensor to Wheel" + "Wheel Width" + "Primary Cut Length".

7.11 The Clamps close.

7.12 The WHEEL HEAD Axis advances rapid until rod O.D. is 0.050 In. from Cutting Wheel.

7.13 The Coolant Valve turns ON.

7.14 The WHEEL HEAD Axis advances at the Major Cut Speed until the Cutting Wheel has cut thru the Rod Diameter+0.50 In. If the Break Thru option was selected then the WHEEL HEAD Axis advances at the Major Cut Speed for the percentage of the Rod Diameter(section 6.23) and then the Break Thru Speed finishes the remainder of the diameter+0.050 In.

7.15 Then the WHEEL HEAD Axis moves rapidly in the home direction to a position 0.250 In. beyond the position outlined at section 7.13 and the Coolant Valve turns Off.

7.16 The WHEEL HEAD Axis then moves rapidly forward to the position outlined at section 7.13.

7.17 Next the Clamps open. If Single Cut was selected or Stop After Cut (F12) was pressed after the cycle was started, the Cycle will pause at this point until F1 is pressed.

7.18 The Pusher advances rapidly the distance of "Wheel Width" + ["Primary Cut Length" or "Secondary Cut Length"]. If the PUSHER Done End Limit Switch is activated during this move the PUSHER and WHEEL HEAD Axis are sent Home and the sequence starts over at step 7.6.

7.19 The Clamps close and the Coolant Valve turns On.

7.20 The machine repeats steps 7.14 thru 7.19 unless it is interrupted by an Emergency Stop or a Fault Condition or Pressing **F11** to Cycle Stop before loading a new rod, Shut Down Auto Cycle and STOP the Wheel Head and Coolant motor.

7.21 If Emergency Stop is used during a Automatic Cycle, the next cycle must be started at step 7.2.

8.0 FAULTS

8.1 When a Fault condition occurs the Automatic Cycle is terminated and all machine functions are stopped and the Clamps close. The Cycle Done/Fault Flashing light will illuminate and flash and the Fault will be displayed on the O.I.U. screen. Upon clearing the fault condition, the machine will be placed in the Manual Mode.

8.2 If the Emergency Stop is depressed, the following message will be displayed.

8.3 E-STOP FAULT

8.4 To clear this Fault, pull out the Emergency Stop Pushbutton.

8.5 Upon initial power up or after a momentary power loss, the following message will be displayed.

8.6 POWER-UP FAULT
CLEAR=RESET

8.7 To clear this fault, press the **CLEAR** Key on the O.I.U.

8.8 In the event of a Wheel Motor Overload, the following message will be displayed.

8.9 WHEEL MOTOR OVERLOAD FAULT OR COOLANT MOTOR OVERLOAD FAULT

8.10 To clear this fault, allow the Wheel Motor or Coolant Motor Overload Relay to cool down and then press the Reset Button on the Overload Relay.

8.11 In the event of a Clamp Solenoid or Clamp Air Pressure failure, the following message will be displayed.

8.12 CLAMP PRESSURE
FAULT

8.13 To clear this fault, check the Clamp Solenoid Valve, the Clamp Air Pressure Switch and then correct the problem.

8.14 During the Automatic Cycle while the Rod Pusher is retracting, if the Rod Edge Proximity Sensor is activated the following message will be displayed.

8.15 ROD EDGE SENSOR
FAULT

8.16 To clear this fault, remove obstruction from Proximity Sensor. If this does not clear the fault then check proximity sensor Gain adjustment, or replace Proximity Sensor and/or amplifier.

8.17 In the event of a Pusher Forward End Limit fault, the following message will be displayed.

8.18 PUSHER FWD LIMIT
PRESS CLEAR

8.19 To clear this fault, press the **CLEAR** Key on the O.I.U. and the message at section 3.4 will be displayed. Press **CLEAR** again and the PUSHER and WHEEL HEAD will go Home.

8.20 In the event of a Pusher Reverse End Limit fault, the following message will be displayed.

8.21 PUSHER REV LIMIT
PRESS CLEAR

8.22 To clear this fault press the **CLEAR** Key on the O.I.U. and the message at section 3.7 will be displayed. Press and hold the Jog Forward Pushbutton until the message at section 3.4 is displayed. Press the **CLEAR** Key and the PUSHER and WHEEL HEAD will go Home.

8.23 While the Pusher is moving the rod or 'No rod' to the Rod Edge Sensor and exceeds the time limit, the following message will be displayed.

8.24 NO ROD FOUND
PRESS CLEAR

8.25 To clear this fault, press the **CLEAR** Key and the message at section 3.4 will be displayed. Press the **CLEAR** Key again and the PUSHER and WHEEL HEAD will go Home.

8.26 This machine has a software programmed Wheel Head Axis Over Travel Limit. If this limit is exceeded the following message will be displayed.

8.27 WHEELHEAD OVERTR OR TABLE OVERTRAVEL
PRESS CLEAR PRESS CLEAR

8.28 To clear this fault, press the **CLEAR** Key and the message at section 3.4 will be displayed. Press the **CLEAR** Key again and the PUSHER and WHEEL HEAD will go Home.

8.29 In the event that the Carbide Rod becomes jammed while being pushed, the following message will be displayed.

8.30 TOOL JAM FAULT
PRESS CLEAR

8.31 Before clearing the Tool Jam Fault, first check the for a problem with the PUSHER or Carbide Rod, then press the **CLEAR** Key and the message at 3.4 will be displayed. Press the **CLEAR** Key again and the PUSHER and WHEEL HEAD will go Home.

8.32 When an error occurs in the Axis Drive, the following message will be displayed.

8.33 ILLEGAL MOVE
PRESS CLEAR

8.34 To clear this fault, press the clear Key and then check for errors in the Setup Entries (speeds, lengths, other).

9.0 ADJUSTING PUSHER VEE CENTER TO WHEEL DISTANCE

9.1 The "Recognized Distance" from the Pusher Vee Block Center to the outside diameter of the wheel, when WHEEL HEAD Axis is at Home position, is used to calculate all WHEEL HEAD Axis moves. If this Distance is altered by changing the Home Proximity switch to Home Target relationship, the "Recognized Distance" used by the PLC must be adjusted using the following steps.

9.2 Remove the splash guards around the wheel.

9.3 Select Manual Mode and press **F9** to home PUSHER and WHEEL HEAD.

9.4 Clamp a known diameter rod in the cutting area of the Vee Block.

9.5 Press **F3** to start the Wheel Motor.

9.6 Press **F7** three times to select the WHEEL HEAD Axis. SEE 9.9

9.7 Press **F8** to select **FAST** jog speed. SEE 9.9

9.8 Press Jog Forward Pushbutton until the Wheel is within 1/2" of the Tool in the Vee Block.

9.9

MAN. WHEEL HEAD		MAN. WHEEL HEAD	
SLOW	XX.XXXX	FAST	XX.XXXX

9.10 Press **F8** to select **SLOW** jog speed. SEE 9.9

9.11 **Carefully** Jog Forward until the Wheel *dusts* the tool.

9.12 Record the WHEEL HEAD position shown at the lower right of the display.

9.13 Add 1/2 of the tool diameter to the display value.

9.14 Press **F9** to home the WHEEL HEAD Axis. After the WHEEL HEAD homes, then press **F3** to stop the Wheel Motor and then **F6** to open the Clamps.

9.15 Press **F2** for Automatic Mode to access O.I.U. screens.

9.16 Access Screen #249 of O.I.U.; follow next line.
Press **MODE** key, then **2** key **4** key **9** key, then **ENTER** key.
The O.I.U. will display the screen as follows.

9.16a V TO WHEEL
X. XXXX

9.16b Enter the value calculated from section 9.13 By pressing "LEFT" arrow key (numbers will then be flashing), then enter "number" with Decimal point. Check entered number, if correct, then press **ENTER** key, if not press **CLEAR** key and reenter number.

9.17 After returning to User Controlled Messages, use the "UP" arrow to find the message as displayed below. Then press **F5** to reset.

9.17a WHEEL WEAR COMP.
RESET=F5

9.18 Press the "DOWN" arrow key once and the message screen as seen below will be displayed. The value shown at the lower right of the display should be the same value as entered at screen #249.

9.18a WHEEL WEAR COMP
+F5 -F6 X.XXXX

10.0 ACCESS TO PLC DATA USING THE O.I.U.

10.1 Many PLC Registers containing Timer settings, Limits, Motor Speeds, Ect. These Registers may be accessed and altered from the O.I.U. This should only be attempted by qualified personnel with a thorough understanding of the PLC Program. If it becomes necessary to view or alter these parameters, use the following steps.

10.2 The machine must be in the Automatic Mode for the Operator to have control of the messages by using the **"UP"** or **"DOWN"** arrow keys. These are the Normal User Controlled Messages.

10.3 To access other O.I.U. Screens, press the **MODE** key on the O.I.U.

10.4 Enter the Number of the screen that you wish to access, one number at a time slowly (slow update time between PLC & OIU) and then press the **ENTER** key.

10.5 When the desired Screen is displayed, you may alter the Information using the numeric keypad on the O.I.U.
If and incorrect Number is entered, press the **CLEAR** key and the previous number will restore itself.
When the correct Number is entered, press the **ENTER** key to accept the new value.

10.6 To return to the User Controlled Messages, press the **"UP"** key.

Alternate method: press the **MODE** key, then enter **0** from numeric keypad and then press the **ENTER** key.

Note: See the HORNER ELECTRIC Operator Interface Unit Manual for more details on the O.I.U.

Precision Abrasive Machinery, Inc.

14200 W. COMMERCE RD. * P.O. BOX 43 * DALEVILLE, INDIANA 47334
(765) 378-3315 * FAX (765) 378-3316

6-25-97

AUTOMATIC CARBIDE ROD CUT OFF SAW

Addendum: Tool End Sensor to Wheel Calculations.

Proximity Switch

The distance from the Proximity Switch to the wheel was established as 3.500" by carefully pushing a 1/8" diameter. rod up to the sensor to find where the signal led activates. This is a static measurement to provide a starting distance.

The proximity switch sensing distance is proportional to the mass of the target (carbide rod diameter).

A trial run of different rod diameters was done to find the mean sensing distance for each diameter shown below.

The Distance Chart below may change from Machine to Machine because of the mechanical position of the Proximity Switch and the Amplifier Gain Adjustment.

Stock Dia.	Measured diameter	Sensor 1/8"Ref.	Difference from Ref.	Mean Distance
1/16"	0.077"	3.500"	-0.045"	3.455"
1/8"	0.141"	3.500"	-0.008"	3.492"
1/4"	0.255"	3.500"	-0.003"	3.497"
3/8"	0.394"	3.500"	-0.008"	3.492"
1/2"	0.526"	3.500"	-0.020"	3.480"
3/4"	0.769"	3.500"	-0.055"	3.445"
1"	1.033"	3.500"	-0.100"	3.400"

Test Run: 6-23-97

Greg Maynard EET

Appendix B: Servo Axis Error Codes Section

Response Methods

1. **Status Only Errors:** Set the *Module Error Present* %I bit and *Module Status Code* or *Axis Error Code* %AI word, but do not affect motion.

Note

Unless otherwise noted, any command which causes a Status Only Error is ignored.

2. **Stop Normal Errors:** Perform an internal abort of any current motion using current ***Jog Acceleration*** and ***Jog Acceleration Mode*** (LINEAR or S–CURVE). The *Drive Enabled* and *Axis Enabled* %I bits are turned OFF after the configured ***Drive Disable Dela***y.

3. **Stop Fast Errors:** Instantly abort all motion by setting the servo velocity command to zero.

The *Drive Enabled* and *Axis Enabled %I* bits are turned OFF after the configured ***Drive Disable Dela***y.

Table B-1. DSM302 Error Codes

Error Number (Hexadecimal) **Response Description Error Type**

00 None No Error All

Configuration Errors

02 Status Only -- Scaled data too big, maximum value in range used -- Axis
03 Status Only -- Home Position > Positive EOT, Positive EOT used -- Axis
04 Status Only -- Home Position < Negative EOT, Negative EOT used -- Axis

Configuration Parameter Errors

10 Status Only -- Position Loop Time Constant too large, Immediate command ignored -- Axis
11 Status Only -- Position Loop Time Constant too small, Immediate command ignored -- Axis
12 Status Only -- Position Loop Time Constant computation overflow, reduced to non-overflow value -- Axis
1E Status Only -- Immediate command Jog Velocity out of range, command ignored -- Axis
1F Status Only -- Immediate command Jog Acceleration out of range, command ignored -- Axis

Program Errors

20 Status Only -- Program Acceleration overrange, defaults to 16.7 million cts/sec/sec -- Axis
21 Status Only -- Program Acceleration too small, defaulted to 32 cts/sec/sec -- Axis
22 Status Only -- Scaled Velocity greater than 1 million cts/sec, 1 million cts/sec is used -- Axis
23 Status Only -- Program Velocity is zero, defaulted to 1 count/sec used -- Axis
24 Stop Normal -- Program Position too large -- Axis
25 Stop Normal -- Unconditional Jump Destination not found -- Axis
26 Stop Normal -- Jump Mask error -- Axis
27 Stop Normal -- Wait Mask error -- Axis
28 Stop Normal -- Parameter Position too large -- Axis
29 Status Only -- Dwell time greater than 60 seconds, 5 seconds used -- Axis

Position Increment Errors

2C Status Only -- Position Increment Overrange error, increment ignored -- Axis

Find Home Errors

30 Status Only -- Find Home while Drive Not Enabled error -- Axis
31 Status Only -- Find Home while Program Selected error -- Axis
32 Status Only -- Find Home while Force Digital Servo Velocity error -- Axis
33 Status Only -- Find Home while Jog error -- Axis
34 Status Only -- Find Home while Move at Velocity error -- Axis
36 Status Only -- Find Home while Abort bit set error -- Axis

Move at Velocity Errors

39 Status Only -- Move at Velocity while Drive Not Enabled error -- Axis
3A Status Only -- Move at Velocity while Program Selected error -- Axis
3B Status Only -- Move at Velocity while Home Cycle active error -- Axis
3C Status Only -- Move at Velocity while Jog error -- Axis
3D Status Only -- Move at Velocity while Abort All Moves bit is set error -- Axis
3E Status Only -- Move at Velocity Data greater than 8,388,607 user units/sec -- Axis
3F Status Only -- Move at Velocity Data greater than 1 million cts/sec error -- Axis

Table B-1. - Continued - DSM302 Error Codes

Error Number (Hexadecimal) Response Description Error Type

Jog Errors

40 Status Only -- Jog while Find Home error -- Axis
41 Status Only -- Jog while Move at Velocity error -- Axis
42 Status Only -- Jog while Force Digital Servo Velocity error -- Axis
43 Status Only -- Jog while Program Selected and not Feedholding error -- Axis

Force Digital Servo Velocity Errors

47 Status Only -- Force Digital Servo Velocity while Jog error -- Axis
48 Status Only -- Force Digital Servo Velocity while Move at Velocity error -- Axis
49 Status Only -- Force Digital Servo Velocity while Program Selected error -- Axis
4A Status Only -- Force Digital Servo Velocity while Follower Enabled error -- Axis

Set Position Errors

50 Status Only -- Set Position while Program Selected error -- Axis
51 Status Only -- Set Position Data overrange error -- Axis
52 Status Only -- Servo Axis 1,2: Set Position while not In Zone error Aux Axis 3: Set Position while ENC3 Velocity > 128 error-- Axis
53 Status Only -- Attempt to initialize position before digital encoder passes reference point. -- Axis
54 Status Only -- Digital encoder position invalid, must use Find Home or Set Position. -- Axis

End of Travel and Count Limit Errors

56 Status Only -- Commanded Position > Positive End of Travel or High Count Limit -- Axis
57 Status Only -- Commanded Position < Negative End of Travel or Low Count Limit -- Axis
58 Status Only -- (Absolute Position + Position offset) > Positive End of Travel or High Count Limit -- Axis
59 Status Only -- (Absolute Position + Position offset) < Negative End of travel or Low Count Limit -- Axis

Drive Disable Errors

5B Stop Normal -- Drive Disabled while Moving -- Axis
5C Stop Normal -- Drive Disabled while Program Active -- Axis

Software Errors

5F Status Only -- Software Error (Call GE Fanuc Field Service) -- Axis

Program and Subroutine Errors

60 Status Only -- Absolute Encoder Rotary Position Computation error -- Axis
61 Stop Normal -- Subroutine not in list -- Axis
62 Stop Normal -- Call Error (subroutine already active) -- Axis
63 Stop Normal -- Subroutine End command found in Program -- Axis
64 Stop Normal -- Program End command found in Subroutine -- Axis
65 Stop Normal -- Sync subroutine encountered by non-sync program -- Axis

Program Execution Errors

71 Status Only -- Too many programs requested in same PLC sweep -- Module
72 Status Only -- Request Program 0-10 with multi-axis program active -- Module
73 Status Only -- Request two programs on same sweep with program active -- Module
74 Status Only -- Request two programs for same axis, lower number program executed -- Module
75 Status Only -- Empty or Invalid Program requested -- Module
76 Status Only -- AQ Move Command Position Out of Range -- Axis

Table B-1. - Continued - DSM302 Error Codes

Error Number (Hexadecimal) **Response Description** Error Type

Program Execution Conditions Errors

80 Status Only -- Execute Program while Home Cycle active -- Axis
81 Status Only -- Execute Program while Jog -- Axis
82 Status Only -- Execute Program while Move at Velocity -- Axis
83 Status Only -- Execute Program while Force Digital Servo Velocity -- Axis
84 Status Only -- Execute Program while Program Selected -- Axis
85 Status Only -- Execute Program while Abort All Moves bit set -- Axis
86 Status Only -- Execute Program while Position Valid not set -- Axis
87 Status Only -- Execute Program while Drive Enabled not set -- Axis
88 Status Only -- Execute Program with active Error Stop (Axis Enabled off) -- Axis

Program Synchronous Block Errors

8C Status Only -- Sync Block Error during CMOVE -- Axis
8D Status Only -- Sync Block Error during Jump -- Axis

EEPROM Errors

90 Status Only -- Flash EEPROM memory programming failure -- Module

Hardware Limit Switch Errors

A0 Stop Fast -- Limit Switch (+) error -- Axis
A1 Stop Fast -- Limit Switch (–) error -- Axis

Hardware Errors

A8 Stop Fast -- Out of Sync error -- Axis
A9 Stop Fast -- Encoder Loss of Quadrature or Linear Feedback Loss of Signal error -- Axis

Digital Servo Alarms

B0 Stop Normal -- Main DC power supply overvoltage -- Axis
B1 Stop Normal -- Control power undervoltage -- Axis
B2 Stop Normal -- Dynamic brake failure Axis
B3 Stop Normal -- Main DC power supply undervoltage -- Axis
B4 Stop Normal -- CNV Overload -- Axis
B5 Stop Normal -- Cooling fan failure -- Axis
B6 Stop Normal -- Over current -- Axis
B7 Stop Normal -- Regenerative discharge energy error; resistor thermal switch open -- Axis
B9 Stop Normal -- Control power undervoltage -- Axis
BA Stop Normal -- Error detected by IPM circuit -- Axis
BB Stop Normal -- Main DC power supply undervoltage -- Axis
BD Stop Normal -- Cooling fan failure -- Axis
BE Stop Normal -- Over current -- Axis

Table B-1. - Continued - DSM302 Error Codes (Continued)

Error Number
(Hexadecimal)
Response Description Error Type
Encoder Alarms
C0 Stop Fast Servo not ready when MCON command is on - may be caused by E-STOP input to amplifier.
Axis
C1 Status Only -- Serial Encoder Battery Low -- Axis
C2 Stop Normal -- Serial Encoder Battery Failed -- Axis
C3 Stop Normal -- Servo Motor Over Temperature -- Axis
C4 Stop Fast -- Servo Motor Over Current -- Axis
C5 Stop Fast -- Loss of Encoder -- Axis
C6 Stop Fast -- Error in encoder pulse detection -- Axis
C7 Stop Fast -- Encoder counter error -- Axis
C8 Stop Fast -- -- Encoder LED is disconnected -- Axis
C9 Stop Fast -- Encoder CRC checksum failure -- Axis
CA Stop Fast -- Unsupported encoder, linear or Type A -- Axis
CB Stop Fast -- Unsupported encoder, Type C -- Axis
DSP Alarms
D1 Stop Fast -- Over current Detected -- Axis
D2 Stop Fast -- Loss of Analog Feedback -- Axis
D3 Stop Fast -- Over Acceleration Detected -- Axis
D4 Stop Fast -- Over Velocity Detected -- Axis
D5 Status Only -- KpVelFix Too Large -- Axis
D6 Status Only -- IntGainFix Too Large -- Axis
D7 Status Only -- Alpha Calculation Overflow -- Axis
D8 Status Only -- IntGain Calculation Overflow -- Axis
D9 Status Only -- Kp Calculation Overflow -- Axis
DA Stop Fast -- FPGA Error Detected -- Axis
Special Purpose Errors
E0 Status Only Custom Loop Type Mismatch Axis
E2 Stop Fast DSP Interrupt failure Module
Follower Errors
F1 Status Only -- Follower Position Error Limit Encountered -- Axis
F2 Status Only -- Follower Velocity Limit Condition Encountered -- Axis
F3 Status Only -- Follower Ratio B value = 0 -- Axis
F4 Status Only -- Follower Ratio B value < 0 -- Axis
F5 Status Only -- Follower Ratio A/B or B/A > 32 -- Axis
Winder Errors
F6 Status Only -- A/B Change Not Allowed in Winder Mode With Follower Enabled -- Axis
F7 Status Only -- Set Winder Position Immediate Command Out of Zone -- Axis
F8 Status Only -- Zone Length Out of Range or Zone Length Change Exceeded 25% -- Axis
F9 Status Only -- Zone Length Change Not Accepted; Previous Change Still in Effect -- Axis
Internal Errors
FD Stop Fast -- System software error -- Axis
FE Stop Fast -- Unrecognized encoder, not supported -- Axis

LED Indicators

There are seven LEDs on the DSM302 module which provide status indications. These LEDs are described below.

STAT Normally ON. FLASHES to provide an indication of operational errors. Flashes *slow* (four times/second) for Status-Only errors. Flashes *fast* (eight times/second) for errors which cause the servo to stop.

ON: When the LED is steady ON, the DSM302 is functioning properly. Normally, this LED should always be ON.

OFF: When the LED is OFF, the DSM302 is not functioning. This is the result of a hardware or software malfunction which will not allow the module to power up.

Flashing: When the LED is FLASHING, an error condition is being signaled.

Constant, CFG LED ON:
The LED flashes slow (four times / second for Status Only errors and fast (eight times / second for errors which cause the servo to stop. The operational error code will be placed in one of the first four %AI status words and the *Module Error Present* %I status bit will be ON.

Constant, CFG LED Flashing:
If the STAT and CFG LEDs both flash **together** at a constant rate, the DSM302 module is in boot mode waiting for a new firmware download. If the STAT and CFG LEDs both flash **alternately** at a constant rate, the DSM302 firmware has detected a software watchdog timeout due to a hardware or software malfunction.

*Irregular, CFG LED OF*F:
If this occurs immediately at power-up then a hardware or software malfunction has been detected. The module will blink the STAT LED to display two error numbers separated by a brief delay. The numbers are determined by counting the blinks in both sequences. Record the numbers and contact GE Fanuc for information on correcting the problem.

OK The OK LED indicates the current status of the DSM302 module.

ON: When the LED is steady ON, the DSM302 is functioning properly. Normally,

this LED should always be ON.
OFF: When the LED is OFF, the DSM302 is not functioning. This is the result of a
hardware or software malfunction which will not allow the module to power up.
CFG This LED is ON when a valid module configuration has been received from
the PLC. Flashes *slow* (four times/second) during the Motion Program Store
function. Flashes *fast* (eight times/second) during the Write User RAM to
EEPROM operation.
EN1 When this LED is ON, the servo drive for Servo Axis 1 is enabled.
EN2 When this LED is ON, the servo drive for Servo Axis 2 is enabled.
EN3 When this LED is ON, the *Force Analog Output* command for Aux Axis 3 is active.
EN4 When this LED is ON, the *Force Analog Output* command for Aux Axis 4 is active.